

## IX. Window into Land Use and Natural Hazards



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# IX. Window into Land Use and Natural Hazards

## 9.1 Introduction

Did you notice any construction on your way to school today? Maybe it was that new fast food place on the corner, a new road, or another housing development for the increasing number of people moving into town. In each case, hundreds of people make complex decisions about what should be built and where, how it should be paid for, and what environmental effects it will cause. Management of land resources such as forests, wetlands, and farmland affects the sustainability of our environment. In this Window, we will examine four challenging aspects of land use in Virginia: Managing Sprawl via Smart Growth, Watershed Protection in the Chesapeake Bay, Waste Disposal – the Case of Scrap Tires, and Mitigating Natural Hazards.



### Objectives

*In this window students will:*

- Discuss ways to protect the environment through improved land management.
- Investigate one or more land use challenges in Virginia and stakeholders involved.
- Identify ways in which natural hazards can be reduced through better land use.

### SOLs

Science 6.1, 6.7, 6.9

### Key Terms/ Concepts

- Sprawl
- Segregated use
- Impervious surfaces
- Growth Management
- Smart Growth
- Mixed-Use Development
- Cluster Development
- Watershed
- Land Trust
- Conservation Easements
- Proffers
- Brownfield
- Greenfield
- Topographic
- Nitrogen Fixation
- Nitrification, Denitrification
- Assimilation
- Eutrophication



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## 9.2 Student Information

The ways we use our land resources pose an ever growing challenge for much of the United States. Whether land is used for a business, home, road, or left as green space, there are considerations that must be taken to ensure the best possible outcome of the use. In this Window, we examine four aspects of land use specific to Virginia.

### *Managing Sprawl via Smart Growth*

Sprawl, or the spreading of more people into less populated areas, happens for a reason – it reflects people’s values and choices, at least in the short term. Cities are growing and expanding at the edges, therefore pushing development into rural areas. The challenge is planning to control sprawl. Sprawl especially affects farmers. As land surrounding farms is developed, it drives the price of land up, making it desirable for farmers to sell the land for a profit. A concern is that green space/farmland will cease to exist close to these metropolitan areas. There are multiple reasons why sprawl occurs, including social segregation, family life, and population growth. Sprawl can positively and negatively affect land use. Positive aspects include economic growth and dispersed city congestion. Negative aspects include destruction of neighborhood communities and increased commuting time, fuel use, pollution, and need for roadways. Several approaches have been developed to manage and plan for “Smart Growth.” There are three areas in Virginia which are highly susceptible to sprawl: Virginia Beach, Loudoun County, and Rappahannock County. You will learn about each of these regions, positive and negative aspects of sprawl, and Smart Growth techniques in this window.



### *Health of the Chesapeake Bay – A Land Use Phenomenon*

The watershed for the Chesapeake Bay includes the District of Columbia, parts of Virginia, Maryland, Delaware, West Virginia, Pennsylvania, and New York. This means that everything that enters the water supply in these areas can eventually end up in the Bay. Watershed management is a method used to control water quality, with three key parts: inventory, planning, and implementation. The

Chesapeake Bay Foundation has a “Save the Bay” campaign trying to raise awareness of the Bay and its value. This and other organizations play a large role in trying to improve the quality of the water in the Bay. Erosion is one cause for concern for the Bay’s condition. As soil and sediment run off the land, it can end up in the Bay or on the banks of waterways, making them smaller and causing flooding. The Nitrogen Cycle also plays a large role in the health of the Bay. High levels of nitrogen and ammonia have negative effects on water quality and plant and animal species. So, how can you help to keep the Bay healthy? Here are a few suggestions: plant grass, shrubs, and trees in bare areas to decrease erosion; construct driveways with gravel or other similar materials to allow for rainwater to pass through and reduce runoff; and do not over fertilize your yard.





### *Waste Disposal – The Case of Tire Recycling*

Discarded tires cause a serious land use problem in the United States. For example, in 2001, 281 million scrap tires were generated. Where do these tires go? Unfortunately, tires do not biodegrade as easily as some other human generated waste and recycling can be expensive. Virginia is one of about thirty states that have implemented tire disposal fees at the time of purchase of new tires. One of the greatest dangers of old tires is the potential for tire fires. When tires catch fire, they release numerous chemicals into the ground and air. The other problem comes in extinguishing the fire; tire fires can be extremely difficult to put out and clean up can take a long time. There are several methods of recycling, some of which include: rubberized asphalt, noise absorbent highway barriers, flooring and roofing materials, playground surfaces, and a fuel source for industrial plants. How can you as a consumer reduce the number of discarded tires? There are four main ways to reduce scrap tire numbers: purchase tires with a longer tread life, rotate your tires every 4,000 miles, check the inflation of your tires for proper pressure, and balance the tires. Tell your parents about how they can get longer life out of the tires they already have!



### *Decreasing Damage from Natural Disasters*

Smart Growth also provides practices which can help protect communities in case of natural disasters. Some examples of natural disaster that exist in Virginia are; hurricane, flooding, coastal storms, tornadoes, droughts, thunderstorms, lightning, and earthquakes. Identifying the potential risks associated with an area and developing plans to deal with those risks are essential to the functioning of a community. For example, a housing developer must identify risk and consider where they build their house and how they design, construct, and maintain it. There are four ways that communities can use Smart Growth to deal with natural disasters: avoiding the impact, lessening the impact by modifying the location, lessening the impact by modifying building design, and offsetting the impact.



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### 9.3 Teacher Content

Sustainable land use planning begins with the people who live in the community. When designing a community, it is important to identify the values of the members. What does your community value and treasure about life? Is it their cars and homes, their family, animals, nature, or a combination of all these elements? Is it most important for your community members to lead fast-paced lives with the most advanced technologies? Is it important for your community members to preserve natural areas and historic sites? Answering these questions will help prioritize the most important aspects of designing a community.

Neighborhoods built during the early 1900s contained homes built close together, with front porches and sidewalk-lined roads. Streets were wide enough to allow parallel parking along the street, but narrow enough that traffic moved slowly to allow a safe environment to walk or ride a bike.

Urban neighborhoods were often close to transit areas and usually contained retail shops within walking distance. Residents had choices of what form of transportation they wished to use: walk, bike, take mass transit, and later in the century they could drive. These urban neighborhoods allowed for the use of cars, but did not depend on cars for transportation. Today, automobile dependence is a key difference in suburban neighborhoods.



## IX. Window into Land Use and Natural Hazards

### 9.4 Managing Sprawl via Smart Growth

In the last half century, much development in the United States has been characterized by **sprawl** – metropolitan areas (cities) growing and expanding at the fringes, pushing development into rural areas (Edelman, et al., 4). This causes some small farmers to sell their farms to commercial vendors, resulting in conflicts and hard feelings between agriculturalists and environmentalists versus business-people. When sprawl occurs, people's homes tend to look similar to their neighbors' and many parts of our large country start to look the same.



Sprawl is directly affecting many counties in the state of Virginia. The random or unplanned spreading of houses and shopping centers surrounding a city is a concern to both residents and environmentalists. Open space and farmland create a desirable atmosphere for many people, providing beautiful landscapes, outdoor recreation, and a small-town atmosphere. Building on land that was once farmland, forest, or open space is usually a permanent decision.

On the positive side, growth can be good economically for a county because the increase in housing and growth in the business area may produce more jobs and generate more tax revenue, better schools, etc. These economic benefits must be compared to the economic, environmental, and social costs that can be a result of unplanned urban sprawl. The state of Virginia and local governments can take action to preserve the land for future generations, while maintaining adequate economic growth. The key to a desired balance by the residents is to create an acceptable development plan of action to guide decision making.

### Why Sprawl Occurs

Sprawl occurs because people want what they believe it offers. Sprawl reflects human values, at least the values and lifestyle preferences of those who can afford it. A variety of factors lead to sprawl:

#### *Segregated Land Uses*

Sprawl has occurred partly because development in our country has been characterized by **segregated uses** – where local government zoning codes restrict land in one area of town for residences (homes), while another area is limited to commercial (business) uses. Consequently, people often live far from where they work and commute by car.

#### *Negative Feelings Toward Cities*

During the 1950s when sprawl began, many families associated living in cities with the Great Depression of the 1930s. When people thought of city life, they thought of their poor, dirty, and difficult childhood in the cities and they wanted something better for their children.



### ***Social Segregation***

It was often the wealthier portion of the population that had enough money to move out of the cities during the last half of the 20th century. Upper class citizens found they could voluntarily segregate themselves from lower income neighborhoods by moving out of the cities into the suburbs.

### ***Perceived Better Schools and Less Crime in Suburbs***

Cities are often associated with crime, so families move out of the cities to provide a safer environment for their children. However, some major U.S. cities, such as New York City, have some of the lowest crime rates in the country. Another reason families tend to move to the suburbs is for the schools. Some suburbs of America have schools that provide an affordable and higher quality education relative to some poorer school districts.

### ***Family Life***

Sprawl attracts families who perceive suburban areas to have better resources for rearing a family – lower rates of crime, better schools, and a more conducive atmosphere for shaping children's values.

### ***Population Growth***

Population growth is a key factor behind urban sprawl, challenging communities to regulate or restrict growth via wise planning. People often prefer to privately commute to work rather than take public transportation. This causes congestion on our roadways and is directly related to air pollution.



The 2000 Census recorded seven million Virginia residents, a 14 percent increase in 10 years. Intensive growth is particularly noted in the Northern Virginia, Hampton Roads, and Richmond areas. According to the Metropolitan Washington Council of Governments, the Virginia “outer suburbs” of Washington will grow three times faster than the rest of the region over the next decade (Loudoun County is the third fastest growing county in the nation).

Virginia has experienced an associated increase of 15 percent in total vehicle miles driven. Virginia now offers more mass transit and other transportation assistance because of the problems associated with the D.C. area, but . . . will this be enough?

Urban sprawl is usually measured in land converted from agriculture. According to the U.S. Department of Agriculture (USDA), over 784,500 acres (three percent of Virginia's 26 million acre land base) were developed in just 15 years in Virginia for projects such as new

subdivisions, office parks, highways, and parking lots. Certain regions have outpaced population growth by an even wider margin. In the Richmond area, the average annual rate of land conversion doubled between 1992 and 1997, whereas the population increased only eight percent during that period. Nationally, population grew 10 percent and vehicle miles driven increased 21 percent.

## *Open Space*

Sprawl disperses city congestion and accommodates the use of the automobile. Many people move from congested cities to live the “country life.” They feel that moving into rural areas offers a quieter environment, with more natural beauty. One or more automobiles have become a presence in almost every household.

## *Jobs*

Sprawl reinforces economic growth. By bringing in people from different areas, cities get a better economic labor force. Different types of people can also help boost a rural area’s economy.

## *Independence*

Sprawl allows people the opportunity to own their own home, yard, and car. Many people enjoy commuting to work and the freedom of not having their personal schedule restricted by the schedule of public transit.

## *Negative Aspects of Sprawl*

### *Transportation*

Because of the separation of land uses, people drive from where they live to where they work. The more we drive, the more pollutants enter the atmosphere and the more oil we consume. Congestion and impatience can result in rudeness, even road rage. Auto-dependence can lead to inactive and sedentary lifestyles.

Our dependence on the automobile causes more roads to be built and **impervious surfaces**, where water cannot penetrate. Impervious surfaces can lead to major problems with the water cycle, excessive floods, and empty groundwater tables.

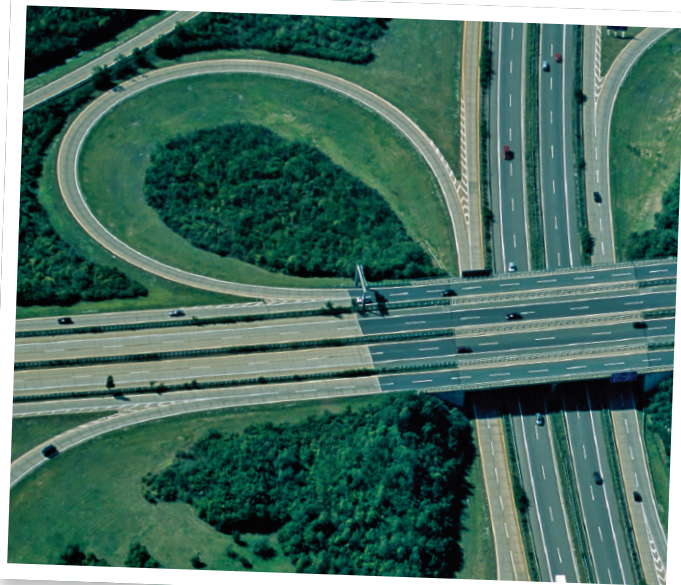
Let us take a closer look at the percentages of workers who commuted to work in 2000:

- Drove alone in a car, truck, or van: 75.7 percent
- Carpooled in a car, truck, or van: 12.2 percent
- Used public transportation, including taxis: 4.7 percent
- Walked: 2.9 percent
- Worked at home: 3.3 percent
- Other means: 1.2 percent

The Bureau of Transportation Statistics within the United States Department of Transportation (USDOT) reported the following data that illustrate the vastness of the transportation infrastructure:

- All public roads total 3.97 million miles (2002)
- Automobiles registered equal 137.6 million (2002)

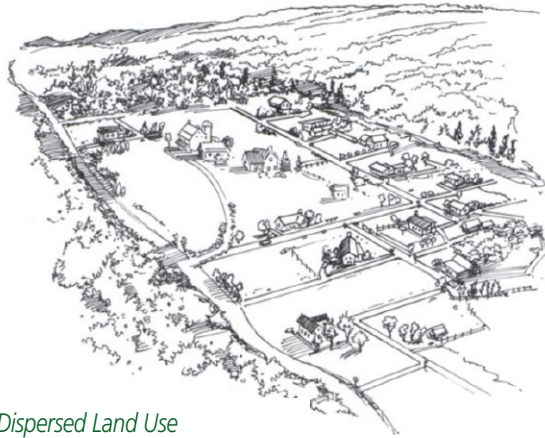
The Center for Urban Transportation Studies reports that “increasingly, coordinated efforts are being made by states to integrate programs and policies, serving to promote transportation options that can



minimize harm to the environment, preserve sensitive lands, and encourage economic development.” Virginia DOT’s participation in the issues concerning the effects of transportation help alleviate some of the negative effects of transportation while providing high-quality services to the public.

### ***Alteration of the Neighborhood Community***

Suburban neighborhoods often consist of large houses placed far apart on large properties, with few connecting sidewalks. Automobile traffic often moves fast, making it unsafe for biking and some other childhood activities. Social interaction within some communities has diminished.



*Dispersed Land Use*

### ***Land Consumption***

The farther people move away from central cities, the more roads that need to be built, adding to the amount of land consumed. These consumptive land practices take up valuable tracts of land, leaving less open space available for farming, forests, wildlife, and recreation. Some areas need to be left untouched in order to preserve natural resources and ecosystem functions.

### ***Increased Costs for Taxpayers***

New development increases the demands on the local government to provide services like roads, schools, utilities and public safety. When new homes are placed farther and farther from the city center, services become more expensive for the government to provide. It has been estimated that for every dollar collected in taxes, government agencies spend \$1.15 to \$1.50 to provide local services (Doughty, 7).

### ***Citizen Conflicts***

Farming produces some odors from animal wastes and chemicals that may be offensive to nearby residents. Having houses and farms in close proximity can create problems for the farmer, e.g., trash thrown from vehicles, curious children getting in with the animals, and noise complaints from the local residents. As more people move into rural areas, farmers may decide to sell their land to local developers. This further reduces the amount of remaining farmland, which in the long run may have a limiting effect on what we eat, and diminish the green open space treasured by rural neighbors.

### ***Meeting Development and Conservation Needs: Smart Growth***

At first glance, development and conservation seem to be mutually exclusive ends. Many communities feel they have to choose between economic growth and preserving the environment, but this is not always true. A successful community can preserve open space, farmland and forests, while also accommodating growth. This can be done by using **growth management** techniques characterized as **smart growth** (Randolph 141).

Growth management techniques are government policies and plans that work as a guide to how a community should develop. Smart growth is the end product of growth management, supporting new development in already developed areas, such as downtowns and suburban centers. Mixed use buildings and cluster zoning is encouraged where government services, such as sewer lines and roads, have already been built. Smart growth helps to conserve open space, while allowing for more development in already developed areas.



## ***Mixed Land Uses***

Instead of separating our land uses, we can develop plans using **mixed-use development**. For example, we can create a community consisting of multi-level buildings that have stores and offices on the first floor, with apartments on the upper levels. Mixed land uses also means having shops and apartments in the same building, serving pedestrians and citizen interaction.



*Intensive Land Use*

## ***Cluster Development***

Cluster zoning (also sometimes called conservation/open space zoning) occurs when development is densely concentrated in some areas, leaving open space and environmentally sensitive lands undisturbed (Randolph, 151).

## ***Preservation of Natural Heritage and Wildlife Conservation***

The preservation of natural heritage refers to preserving the parts of a community that reflect the values and the history of the community's creation. Preserving natural heritage could be done by not developing the last piece of undeveloped land in a town, or by not allowing a strip mall to replace an historic building, depending on the values of the citizens.

Regarding wildlife conservation, many private landowners in Virginia dedicate much acreage, like Piney Grove (see Introduction), to provide wildlife habitat.

## ***Multi-Dimensional Transportation Choices***

It is important to give citizens several transportation options: walking, biking, using mass-transit or driving in order to travel. Sidewalks and bike lanes encourage alternate forms of transportation.

## ***New Urbanism***

Instead of new development, first priority can be to restore the downtown area to use it more effectively. Many downtowns have lots of room available for renovation. Roads and water services already exist in these areas; hence, taxpayers will not have to pay large sums for additional infrastructure and government services.

## ***Preserving Land and Nature's Services***

Land that has not been developed is important to a community. Agricultural lands, or working landscapes provide food, employment, and community character and pride. Natural resources include forests, water bodies, wildlife, and minerals. Forests offer numerous benefits to a community: purifying water, reducing flood damages, providing oxygen for humans to breathe, absorbing ("sequestering") the greenhouse gas carbon dioxide from the atmosphere, and providing habitat for wildlife. Wetlands provide a variety of critical biological and ecosystem services.

## ***Community Collaboration***

To wisely manage sprawl, communities across the United States need to work together. All residents need to be involved. Smart growth principles mean that both development and conservation are possible! Protecting the environment does not necessarily mean that business has to suffer. Designing a community with multiple-use buildings and cluster zoning allows people to walk or bike instead of always driving. Designing multi-level, mixed-use buildings within close proximity to one another consumes less land, leaving more land for farmland, forests, open space, and community interaction.

## ***Development Trends in Virginia***

The northern region of the state is experiencing immense shifts in land use with increased amounts of subdivisions and commercial development. Data from the Natural Resources Conservation Service (NRCS) of the USDA indicate that between 1987 and 1996 Virginia lost an average of over 45,000 acres of land each year to development. In particular the counties of Loudoun, Fauquier, Rappahannock, and the city of Virginia Beach are encountering large-scale development in a relatively short time period.



### ***Virginia Beach and Loudoun County***

Virginia Beach and Loudoun County are unique because they are quite urbanized and yet have a significant agricultural industry. For example, Loudoun County is developing quickly due primarily to its close proximity to Washington D.C. Yet, it had \$24.8 million in agricultural sales in 1997 (U.S. Census of Agriculture), even though the amount of farmland in Loudoun County decreased by 10,000 acres from 1992 to 1997 (U.S. Census of Agriculture). The Loudoun County supervisors and residents wish to control the development; therefore they have adopted Smart Growth techniques in order to preserve land and natural resources.

### ***Rappahannock County***

Competition with the uses of land is a major cause of urban sprawl pressures in many areas such as Rappahannock County. Land that is used for agricultural production or open space may be sold for great amounts of money relative to the income it provides as undeveloped land. The more developed an area becomes, the more pressure landowners may feel to sell or develop their land because the scarcity of undeveloped land causes the price of land to rise considerably. Also, the population of farmers is aging, with many at the age of retirement and with few young farmers to replace them, leaving fewer options for retiring farmers to choose what to do with their farmland.

The Rappahannock Planning Commission views this as a cause of the “end of viable county agriculture.” Rappahannock County has become better equipped to respond to the changing atmosphere and increased population. Possible approaches the commission can use to curb the effects of diminishing farmland include the purchase of development rights, village development, and enhancing the use of transportation planning.

## ***Urban Revitalization – “Renovate and Reuse”***

Urban revitalization is related to infill development. When buildings become vacant and residents and businesses leave a certain area, often that area falls into decay. Poverty and crime increase. Revitalizing urban downtowns and areas with existing buildings and infrastructure is important when looking at how to re-design a community.



In order to maintain existing green space, city planners redevelop and reuse existing buildings (Roseland 125). A **brownfield** is a term used to classify abandoned or under-used plots of land or buildings (Randolph 129). Oftentimes a piece of property or building becomes a brownfield because it may have been contaminated in past use. For example, in many downtown areas you may see a vacant building that has been for sale for a long time. Potential business might want to locate there, but who wants to buy a building that might be contaminated? Potential buyers move outside of the urban downtown and build on unused

property, called a **greenfield** – open, natural, or agricultural lands that provide habitats for wildlife, ecosystem benefits, timber and food production, and aesthetics (Randolph 41).

## ***Development Proffers***

**Proffers** help shift some costs of development from local taxpayers to construction companies, whether or not they are local residents. Proffers are agreements and modifications developers make to protect the environment in order to get a permit to build a new subdivision, malls, office-buildings, etc.

When a proffer is agreed upon, developers will either pay money, called cash proffers, or agree to build private or public improvements to the county such as new roads, highway interchanges, parks, schools, etc. In many states, proffered zoning does not exist, but similar approaches are being used across the nation.

Proffered zoning can avoid some negative effects of urban sprawl. These indirect “taxes” can help control the amount of congestion in a city. For example, a developer may be required to build a parking garage or an additional exit ramp onto a highway. These agreements would help minimize congestion on the roads. Proffers can help promote the aesthetic appearance of a town.

Some residents oppose proffers for fear that they will increase the price of the construction or limit development. Another issue with proffers is that some counties receive more money than they spend from cash proffers. Where does that extra money go? Some proffer payments to the county are not used in the same vicinity.

In conclusion, developers may have to pay more to build there, but the town benefits from the improvements. Inevitably, property owners pay for proffers because the cost will be passed on to the final buyer - the homeowner or commercial owner.



## ***Land Trusts and Conservation Easements***

The legendary Will Rogers once said, “Buy land. They ain’t makin any more of it.” Every day our country loses approximately 5-10 square miles of land to development. Subdivisions and sewer lines are replacing land once used for recreation, farming, or relaxation. However, the trend is slowing. Land conservation is rapidly entering mainstream American culture. In 2002, American voters approved funding of over \$5.7 billion dollars for the protection of open space. **Land trusts** and **conservation easements** are increasingly popular tools in the protection of land. For example, Western farmers are selling development rights on their lands, New York is protecting upstate **watershed** land instead of installing a water filtration plant, and in Virginia a variety of organizations like Friends of Chesterfield County and The James River Association offer guidance to private landowners.

Land trusts are non-profit organizations that work to conserve land by purchasing or accepting donations of land or conservation easements. Land trusts are not government agencies, but many times they work with government agencies to acquire land. Land trusts also work with government agencies to determine locations of threatened land and which open spaces would most benefit the community. Organized as charitable organizations under tax laws, they receive a variety of tax benefits. Land, easement, and monetary donations to a trust will qualify donors for income tax deductions. The Nature Conservancy, the world’s largest environmental organization, is an international land trust that has protected 116 million acres around the world.

Land trusts use a variety of legal and financial tools to help keep precious lands undeveloped. Yet many Americans are unaware of the benefits of land donation or preserving development rights.



Conservation easements are tools for keeping America beautiful and allowing families to hold on to family farms and forests (Appalachian Voice 3). A conservation easement is created when the owner of a piece of property voluntarily donates the development rights on their property. A government or nonprofit conservation organization, such as a land trust, holds these development rights permanently. Conservation easements allow for property owners to maintain ownership of their land while placing permanent restrictions on the type of development that can occur on the land. These restrictions on development remain permanent even if ownership of the land changes.

Not only do conservation easements allow for permanent protection of the beautiful American landscape, they also allow for family farmers to survive economically. Family farms are taxed at the same level as developed land. This heavy tax burden often forces farmers to sell their land. A conservation easement relieves this burden by giving tax breaks and cash payments for those who donate their development rights (Appalachian Voice 3). The farmer and the community both win: farmers receive tax breaks, cash payments and the opportunity to continue farming with no development pressure; the community receives the environmental services and aesthetic beauty from the natural lands.

The White Rock Farm Conservation Easement, granted in 2008 by John and Sandra LaPrelle, **protects nearly 2,700 acres of scenic, recreational, habitat, water quality, and timber resources**. The property, located in Smyth County near Rural Retreat, is surrounded on three sides by the Jefferson National Forest, located within the U.S. Forest Service Proclamation Boundary, and drains into both the New River and Tennessee River watersheds. The Appalachian Trail crosses the property at one corner, and its mountaintops provide scenic view for the traveling public. (*XII. Corporate Case Study – White Rock Farm Conservation Easement, page XII:6*).

## IX. Window into Land Use and Natural Hazards

### 9.5 The Health of the Chesapeake Bay – A Land Use Phenomenon

A watershed is a geographic area in which water, sediments, and other materials drain into a common body of water. Watershed management is a method of water quality control, influencing the health of a water body by monitoring the land that drains into a particular water body. It is based on the premise that water quality and ecosystem problems are best dealt with at the watershed level, instead of at the individual water body or discharge level. There are three components to watershed management programs: inventory, planning, and implementation.

Watersheds are typically large. For example, the watershed for the Chesapeake Bay includes the District of Columbia, parts of Virginia, Maryland, Delaware, West Virginia, Pennsylvania, and New York. [www.chesapeakebay.net](http://www.chesapeakebay.net)

#### *Where Does the Bay Begin?*

Some rest rooms on the University of Virginia campus have stickers on the mirrors over the faucets that say, *The Bay Starts Here!* Indeed, our cumulative actions on land can have downstream effects throughout the watershed that empties into the Chesapeake Bay. Nearly 16 million people live within the boundaries of the Chesapeake Bay watershed. These residents demand land, water, and energy from the watershed's resources, which negatively affects the health of the Bay by disrupting natural lands and groundwater tables, destroying wildlife and plant species habitat, accelerating erosion, increasing waste and litter, and extracting energy from our natural resources. As we build new homes, shopping centers, schools, and roads, the forests, wetlands, fields, and shoreline within the Bay watershed are disturbed. These natural features play important roles in preserving the health of the Bay by filtering water and urban runoff, controlling erosion, serving as storm weather buffers, and sequestering carbon.

#### *Making Connections with the Bay*

Imagine a drop of rainwater falling from the sky and landing on your driveway. Because of gravity, this drop of rainwater runs down your driveway, crosses the road, and runs into a drainage ditch where it is carried away. This water is called *runoff*. But where does it go? If you are part of the Chesapeake Bay watershed, then that drop of water ultimately ends up in the Bay. On its journey from the sky, down your driveway, across the road, and all the way to the Bay it picks up many different types of pollutants that are all over the earth, like the nutrients nitrogen (see next page for a discussion of The Nitrogen Cycle) and phosphorus commonly used in fertilizers (urban and agricultural).

What is causing the Bay to be under so much stress? The biggest contributor to the damage is our growing population combined with our daily activities. Even though the Bay may not look dirty, there are many unseen pollutants present. For example, when a house is built, by disrupting the soil and exposing it to wind and rain, those sediments often end up in the Bay's tributaries. What is wrong with a little extra soil in our rivers? The abundance of sediments in waterways is a form of pollution called Non-Point Source (NPS) pollution and causes problems like flooding of waterways.

Another contributor to the degradation of water quality is runoff from farms. Each year, in order to have a successful crop, many farmers apply fertilizer. However, if a soil test is not done to find out precisely how much fertilizer is needed, it is likely that too much fertilizer will be used and the extra fertilizer that contains chemicals like nitrogen and phosphorus can be washed away with rain into

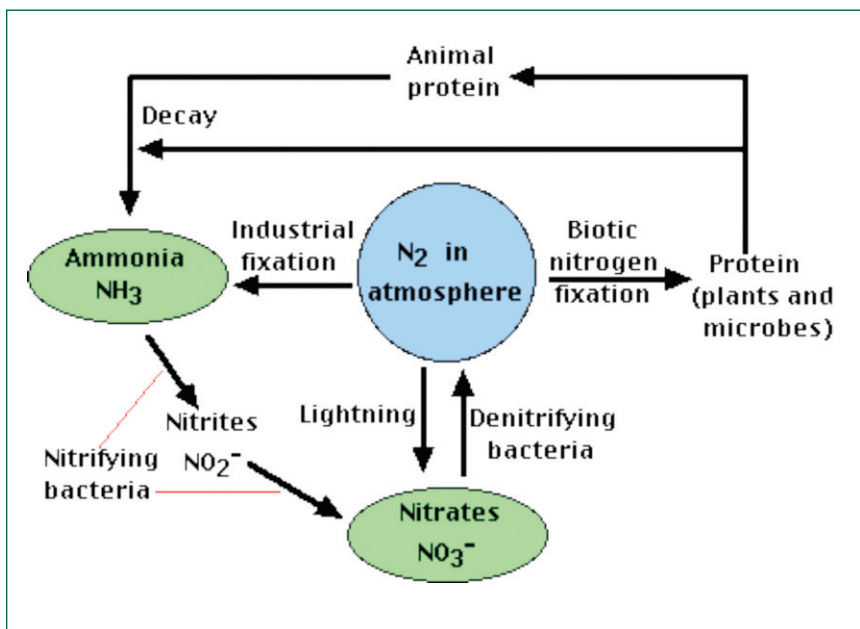
the waterways. Excess nitrogen is causing massive algae blooms to occur. These blooms, along with sediment deposited in the Bay, cloud the water and keep the sun from penetrating to the floor of the Bay. Plants cannot grow without sunlight to aid in the photosynthesis process. Much aquatic life depends on Submerged Aquatic Vegetation (SAV) for food and protection and it helps prevent erosion.

Aquatic life is not the only dimension suffering from the degradation of the Bay. It is home to over 3,600 plant and animal species and provides us with much seafood, diverse recreational opportunities, and water to cool the power plants that fuel our economy.

## Nitrogen

### The Nitrogen Cycle

Our Earth's atmosphere is about 78 percent nitrogen, 21 percent oxygen, and one percent various other gases such as helium, argon, and hydrogen. Although there is a large amount of nitrogen in the



air, it cannot be used directly by plants and animals. A process involving bacteria allows plants to use nitrogen from the air, soil, or water. Plants and animals need nitrogen to live. Without the nitrogen cycle, plants, and thus the animals that live off them, would not be able to use nitrogen.

### Sources of Ammonia

For plants to use atmospheric nitrogen, it must be turned into nitrate by bacteria in the soil, water, or in the roots of some plants. This process is called **nitrogen fixation**. The nitrate ion is composed of one nitrogen atom and three oxygen atoms. Nitrate is an ion, meaning that it carries a charge. There are several sources of

nitrogen for this process. Atmospheric nitrogen (N<sub>2</sub>) is converted into ammonia (NH<sub>3</sub>). There is also an industrial process that can be used to turn nitrogen into ammonia for fertilizers, which, along with animal manure, is a large contributor to nitrogen in the soil and water. Another source of ammonia for the nitrogen cycle is decomposition of nitrogen in biological molecules into ammonia when bacteria or fungi called decomposers break down decaying animals and plants.

### Positive Effects of Nitrogen

Plants can directly use ammonia, but most of the ammonia is used by bacteria for energy. When bacteria get their energy from ammonia, nitrite (NO<sub>2</sub><sup>-</sup>) and then nitrate (NO<sub>3</sub><sup>-</sup>) are formed. This process is called **nitrification**. Plants use nitrogen in a process called assimilation when they absorb ammonia and nitrate into their roots from soil or water. This allows them to form important nitrogen containing molecules such as amino acids, which are the building blocks of proteins that are essential to life. For the nitrogen cycle to be complete, the nitrogen-containing compounds in the plants and animals have to be returned to the soil (by decomposers such as bacteria) or to the atmosphere (in a process called **denitrification**, in which bacteria turn the nitrate back into atmospheric nitrogen).



### ***Negative Effects of Nitrogen***

Although nitrogen in soil and water is necessary for life, too much of it can be bad for the environment. When ammonia and nitrate are converted into atmospheric nitrogen by bacteria, a dangerous gas called nitrous oxide is formed. It depletes the ozone layer that protects us from the harmful radiation of the sun, which can cause skin cancer.

Another harmful effect of too much nitrogen occurs when it gets into water, causing the water to be harmful to living organisms. The nitrates from the nitrogen cycle enter the environment as PS and NPS pollution. In drinking water, excessive nitrates are toxic to infants and young livestock. In streams and oceans, it contributes to the depletion of the oxygen dissolved in the water, thereby killing fish because the extra nitrogen causes too much growth of aquatic plants and algae. As they decompose, the oxygen dissolved in the water is depleted. Also, excess algae growth, known as algae blooms, blocks sunlight from reaching the deeper waters, causing the submerged plants to die. Since plants produce oxygen, their loss reduces the oxygen in the water. The lack of oxygen causes aquatic animals to die. This process of excessive growth, decay, and depletion of oxygen is called eutrophication.

### ***Keeping the Bay Clean and Healthy***

- Plant grass, shrubs, flowers, and trees in bare areas. This will help decrease erosion and sedimentation.
- Reduce the amount of impervious surface, such as asphalt and concrete. Construct your driveways and walkways with gravel in order to allow rainwater to infiltrate or soak into the earth.
- Soil tests are simple and may be acquired from your local extension agent. By testing your lawn before applying fertilizer, you can reduce the excess nutrients that runoff into our waterways.
- Simple water conservation practices like taking showers instead of baths or not leaving the water running the whole time you brush your teeth also helps.



## IX. Window into Land Use and Natural Hazards

### 9.6 Waste Disposal – The Case of Tire Recycling

Tires provide numerous benefits to consumers, especially for motor vehicle transportation. However, discarded tires cause a serious land use problem in the United States: proper disposal of many millions of scrap tires. For example, in the year 2001, 281 million scrap tires were generated (EPA). Dumping old tires in a “pile” and letting them slowly rot to waste is a practice of the past. Though tires can be recycled, the general public rarely hears of recycling tires for their many different uses.

Over 30 states in the U.S. have implemented tire disposal fees. These fees fund the many ways tires are recycled. Virginia is no exception to the requirements placed on tire distribution companies for the recycling of tires. The State of Virginia imposes a tire disposal fee for every new tire purchased, paid when the tires are purchased. Not only do most states have tire disposal fees, they also have restrictions on the placement of tires in landfills, as well as on the hauling, processing, and storage of tires (RMA).

A positive point to the tire recycling issue is that a market exists for recycling of 78 percent of the scrap tires. In, 1990, there was a market for only 17 percent of used tires, according to the EPA. The Virginia Department of Environmental Quality (DEQ) began locating tire dumps with a comprehensive state-wide survey in 1993. That year, 731 piles containing over 17 million tires were identified, quantified and certified. Since then, almost 500 additional new piles (“new finds”) containing approximately 8 million tires have been located and documented. New finds are reported regularly, with 21 in 2007 alone. Thus, DEQ has been tasked with dealing with 25 million tires in over 1,200 locations throughout the Commonwealth. <http://www.deq.virginia.gov/wastetires/progsummary3.html>

#### ***Tire Fires***

A major problem with used tires is the potential for a fire. According to the EPA, tire fires are infrequent, but quite difficult to extinguish and clean up. When tires burn, numerous chemicals are released into the ground and air. Due to the problems with extinguishing these fires, the length of time air and soil pollutants are exposed to the population is prolonged. More recently, companies and agencies have been doing more to prevent the stockpiling of tires, which in turn, helps to minimize the severity of tire dump fires and the release of pollutants into the ground and air.



One of the largest incidences of tire burning in Virginia occurred in Roanoke County in 2002. The fire started because of a brush fire adjacent to the property of the stockpile. A voluntary evacuation of two neighborhoods close to the tire stockpile was conducted within 48 hours of the start of the fire. Over 3 million tires burned for over 30 days. Taxpayers spent \$3 million for the clean up efforts after the fire was extinguished. This fire released numerous chemicals into the air and soil.



#### ***Ways to Reduce the Number of Scrap Tires***

Consumers can help prevent the number of scrap tires accumulated each year. According to the *Rubber Manufacturer's Association* (RMA), there are four main ways to help prevent the stockpiling of tires. First, consumers can purchase tires with longer tread life. Second, rotating the tires on your



vehicle every 4,000 miles can help ensure a longer tread life. Third, RMA recommends checking the inflation of the tires twice a month to ensure the required amount of pressure. Finally, properly balancing the tires, when having them rotated, ensures proper wear on the tire, which helps to increase tread life.

### ***Methods of Tire Recycling***

There are several ways tires may be recycled. Tires are used for rubberized asphalt, highway noise barriers, flooring and roofing material, playground surfaces, and fuel sources (EPA). Tire fires in a controlled environment can provide an energy source. Following are examples of how tires can be used after recycling:

- Rubberized asphalt from recycled tires has significant benefits over regular asphalt. According to the Rubberized Asphalt Concrete Technology Center, there are five main benefits. First, rubberized asphalt is more cost effective. Second, it is quieter and more skid resistant. Third, it is environmentally friendly. Fourth, rubberized asphalt provides long lasting color for highway markings. Lastly, it resists cracking, therefore making it longer lasting and requiring less maintenance.
- Tires may also be recycled to create more a more noise absorbent highway barrier. Made in the same manner as the rubberized asphalt, these highway noise barriers absorb more noise than concrete barriers.



- Another possible recycling method for tires is in roofing and flooring materials. Roofing materials made from used tires have a similar appearance to cedar or slate. The estimated life expectancy of the roofing system using recycled tires is greater than 50 years. Recycled tires are also used to make floor mats for vehicles and kennels.
- Playground surfaces are now being outfitted with recycled tire chips. There are several advantages to using recycled tire chips as a playground surface. First, the material does not rot or decay. Second, recycled tire chips have easy maintenance. Third, the chips are safe and non-toxic. Also, the material does not attract insects like mosquitoes that infest tire piles, thereby helping to prevent the spread of infectious diseases (Entire-Cushion).
- Scrap tires are also recycled for use as a fuel source for paper mills, power plants, and industrial boilers. Generally, used tires are cheaper than using coal (Ohio Department of Natural Resources). When tires are used as an energy source, the harmful chemicals are maintained in a safe manner. This reduces the chances of toxic chemicals being released into the soil and air.

There are obvious benefits to the public from the re-use of tires. However, many uses are unknown to the general public. Expanding these uses allows for further reduction in air and soil pollutants and also minimizes the large quantities of tires in stockpiles. The underlying benefit of increasing the prominence of recycled tires is to make the general public more aware. This makes the general public more aware of recycling and therefore more aware of the tire when used for motor vehicle transportation.



## IX. Window into Land Use and Natural Hazards

### 9.7 Mitigating Natural Hazards

Smart Growth development practices can help offset the dangers and unpredictability of locating structures along the coast and in other areas prone to natural hazards. Some of these practices are identification of hazards, such as flood levels and erosion rates. Developers and landowners must consider where they site their buildings, along with consideration of design, construction, and maintenance of the building (Randolph 220). There are regulations in Virginia about building in environmentally sensitive areas such as wetlands, flood plains and sand dunes.

[http://www.dcr.virginia.gov/chesapeake\\_bay\\_local\\_assistance/index.shtml](http://www.dcr.virginia.gov/chesapeake_bay_local_assistance/index.shtml)

#### Hurricanes

Hurricanes are caused by warm humid air over the tropical regions of the ocean that can cause major differences in air pressure, eventually creating a cyclone. In the northern hemisphere, these cyclones blow counterclockwise. When the strong winds that make up a cyclone reach 74 mph or more, they become hurricanes. A hurricane can have a diameter that extends 1,000 miles. Once the storm reaches land, the wind speeds slow down, causing the hurricane to lose energy. Even over land however, hurricanes still cause damage because of their high winds, torrential rains, and floods. The damage caused by hurricanes can be severe: overturned houses, ruined crops, drowned people, lost livestock, etc. Only a few hurricanes that hit the eastern seaboard actually make it all the way to Virginia and most hurricanes that pass through Virginia affect only the Tidewater region.



Hurricane Isabel struck Virginia during September of 2003. This massive storm killed 19 people and left 1.2 million Virginians without power. While the excessive amount of water dumped by Hurricane Isabel led to heavy tree loss and damage, farmers need a sufficient amount of rainfall for their crops. If the late summer rainfall does not reach Virginia, farmers can lose \$4 million a year because of losses to their soybean and corn crops (van der Leeden 33).

The response of local communities affected by Hurricane Isabel demonstrates the benefits of community cooperation and prior planning for natural disasters. When Virginia experiences a disaster, the Virginia Cooperative Extension (VCE) directs an agent from its

Agriculture and Natural Resources Division to assess the damage from the storm. During Hurricane Isabel, VCE was unable to send agents to every community, but because those communities worked together and planned properly for the event, storm damage reports were still made in a timely manner. More than \$87 million worth of agricultural losses was recorded in 54 counties and cities across the state. These damages mostly affected the eastern and northern parts of Virginia, but damages did reach as far west as Rockbridge, Augusta, and Rockingham counties.

The VCE was able to send agents to assist many of the local communities by providing information on food safety, precautions about water contamination, safety guidelines on use of chainsaws, health risks and removal of mold, and other precautions for during and after the storm. Repeatedly during Hurricane Isabel, VCE agents were the primary link that connected local people in distress with the proper state or federal agency or private enterprise to address compelling needs. Virginia can be proud of the way the local communities cooperated and planned accordingly to effectively deal with Hurricane Isabel.

## Floods

Related to hurricanes is the phenomenon of flooding. In fact, during the 20th century, flooding caused more lives to be lost than did hurricanes. Flooding occurs almost every year in Virginia. During a hurricane, tides have been reported to be 12 feet above normal. Hurricane Isabel flooded major portions of Northern Virginia and the Tidewater region, causing numerous schools and businesses to shut down until the water receded.

Flooding can occur even without a hurricane. Moisture and storms move inland from the Gulf of Mexico, the Caribbean Sea, and the Atlantic Ocean, hitting the Blue Ridge Mountains, which causes the air to rise and cool. This rising and cooling of air intensifies rainfall for Virginia. Most serious flooding occurs in the Roanoke, James, and Potomac River basins. Three key factors that affect



flooding are (van der Leeden 41):

- *Climatic* – these include rainfall intensity and duration, distribution of rainfall in the drainage basin, direction of the storm movement, and the type of storm.
- *Topographic* – these include the size and shape of the drainage basin, land slope, and storage.
- *Geologic* – these include water-bearing characteristics of the soil and the nature of the near-surface rock formations.

### Methods to Control Flood Damage

The first method involves using structural measures to lessen the impact of flooding. These include building dams, reservoirs, floodwalls and enlarging channels to control floodwaters. Elevating existing structures, such as houses, also serves to prevent flood damage. Though using structural methods to control flood damage has benefits and works well, it can lead people to have a false sense of security about their safety.

A second method to control and/or ameliorate flood damage is to use non-structural measures, such as flood warnings, relocating buildings to safe areas, monetary relief, and affordable insurance. An important non-structural component to lessening flood damage is to provide citizens with information about flood risks and safe building practices for structures in floodplains. Most important is future floodplain planning that regulates development in areas prone to flooding (Randolph 208).

[http://www.dcr.virginia.gov/dam\\_safety\\_and\\_floodplains/fpregs.shtml](http://www.dcr.virginia.gov/dam_safety_and_floodplains/fpregs.shtml)

The National Weather Service (NWS) operates a flood warning system. The NWS forecasts and declares severe weather watches, giving citizens warning that a flood may occur. Virginia has a flash-flood warning system called the Integrated Flood Observing and Warning System, also known as IFLOWS, which is a network of computer systems that monitor 229 rain gauges and 39 stream gauges (van der Leeden 43).

## Coastal Storm Hazards

For Virginians living on the eastern edge of the state along the Atlantic Ocean, coastal storms can have a big impact on daily life. Hurricanes, high winds, heavy rains, and elevated wave levels all combine to form dangerous situations for residents. Beach erosion is a major concern because of high winds and mobile sands. The boundary between the beach and the ocean does not remain the same over the long run, but can change hundreds of feet over decades. This can cause problems for buildings located on a beach. For example, when a home was built, it may have been 200 ft. from the ocean,

but after 40 years, the house may become washed away due to the constant movement of sands on the beach. Therefore, siting and design of coastal homes and buildings must be carefully planned. <http://www.deq.virginia.gov/coastal/sf2008magdunesanddeaches.html>

## **Tornadoes**

Although tornadoes have been known to occur in Virginia, they are not common and the tornadoes that affect Virginia are usually not nearly as severe as those that occur in the midwestern part of our country. Since 1765, 250 tornadoes have been recorded in Virginia. Tornadoes are created from severe thunderstorms that pull hot moist air upwards from the ground. This air forms thunderheads that are surrounded by strong, upward spinning winds. Eventually this movement of swirling winds becomes a tornado. The funnel, center section of the tornado can reach winds up to 300 mph. These strong winds can demolish anything they contact, including houses and cars. Southwest Virginia has had fewer tornado incidents than anywhere else in the state, mainly because the mountains tend to break up the storms (van der Leeden 47).

## **Droughts**

Droughts are prolonged water shortages that can last for a few months or several years. They can cause major crop losses to farmers. In Virginia, droughts occur about once every 10 years, but most affect local areas only and go unnoticed by other regions of the state. During periods of drought, local governments often ask for citizens to stop any unnecessary water use, such as watering lawns and washing cars. This decrease in demand helps keep reservoirs from drying up during periods of reduced supply (van der Leeden 51).



## **Thunderstorms**

Thunderstorms affect the mountainous region of southwest Virginia more than anywhere else in the commonwealth. On average, 32 to 50 days out of the year Virginia experiences a thunderstorm. The time of year most common for thunderstorms to occur is during the months from May to September, but most thunderstorms that strike the state are not classified as severe. Thunderstorms by themselves do not pose much risk for Virginians, but when accompanied by wind, rain, and lightning, they can be very dangerous (van der Leeden 47).

## **Lightning**

Lightning often accompanies thunderstorms, causing property damage, injuries, and death. Lightning events kill twice as many people each decade as tornadoes in Virginia. They originate because of positive and negative charges between thunderclouds and cloud droplets and the ground. One lightning strike can spark up to 100 million volts of electricity! Lightning traveling from cloud to ground is the most common, but lightning can also travel from cloud to cloud, often striking and damaging unsuspecting aircraft. Not to worry though: lightning does not penetrate aircraft. The electrical current flows around the outside, usually leaving passengers safe (van der Leeden 53).

## **Earthquakes**

Like tornadoes, earthquake hazards are less severe in Virginia than in Western states, such as California. Earthquakes occur because of the tectonic movement of crustal plates that lie just under the Earth's surface. These disruptions under the Earth's surface can cause major damage to human developments,



mostly because of ground shaking, which can affect areas far from the source of the earthquake itself. The amount of damage from ground shaking depends on the underlying bedrock and soils and also the type of human-made structures. Wooden structures tend to hold up better than brick buildings (Randolph 236).

The potential of an earthquake to occur in Virginia does exist. Western and Central Virginia experience more earthquakes than the Piedmont and Coastal Plain regions of the state. The largest earthquake ever recorded in Virginia, and the second-largest shock ever recorded in the Southeastern U.S., occurred in Pearisburg in Giles County on May 31, 1897. Thirteen southeastern states felt that earthquake. Even though that quake was a long time ago, the hazard is still present. By the year 2015, there is a 33 percent chance of an earthquake causing damage to Virginia. The severities of earthquakes are measured by their intensity and magnitude. The Mercalli Intensity Scale measures intensity, and magnitude is measured by the Richter Scale (van der Leeden 56).

### **General Natural Hazard Protection**

Even though natural disasters seem unpredictable and incredibly strong, there are ways for communities to help reduce the impact of natural disaster events. Here are four ways that communities can deal with natural disasters (Randolph 202):

- Avoid the impact (relocate away from natural disaster areas).
- Lessen the impact by modifying the location (move away to a lesser impacted area).
- Lessen the impact by modifying building design (use engineering techniques).
- Offset the impact (providing money or resources to rebuild).

Guidelines also exist to lead community leaders to better prepare their residents for major storm events. The planning process initially identifies objectives. These objectives usually call for reducing or avoiding the impact of natural disaster events. Next, city planners do a risk assessment of the area. This risk assessment looks at the vulnerability of the population to harm from a storm event. The next step is to develop alternatives to reduce the impact of a storm. These include education and raising awareness among the citizens about the actual risk of a disaster, relocating buildings, rebuilding after storms, and lessening impact by design. After developing methods for handling a natural disaster, the community implements and evaluates the plan before and after each storm event (Randolph 205).



Although scientific forecasting has improved a lot in the last few decades, better methods for advanced warning need to be researched and created. Of course, no matter how perfect the forecasting technique, if your home is located in the path of a storm, protecting yourself and family is first priority. Improving emergency response preparedness is also important for communities. It is a logical first step that the U.S. Federal Emergency Management Agency (FEMA) will not grant communities flood insurance unless they have a floodplain management plan, but communities need to continue to work on what they expect citizens to do when a natural disaster strikes.

Damages due to natural hazards continue to rise, even though there has been an increase in federal money spent on natural disaster control, emergency plans for vulnerable areas, and better forecasting of potential disasters. The increase in damages is partly a result of the *Disaster-Relief-Disaster* syndrome.

The relief portion of the syndrome sometimes consists of government money used to rebuild, often in the same hazardous location, after each natural disaster occurrence. Important questions need to be addressed: should the government continue to use taxpayers' money to help rebuild buildings in areas where they are most likely to be destroyed again in the future? Should people be allowed to build their homes and locate their businesses in areas prone to flooding and other natural disasters?

### **Virginia Case Studies**

You can read about scenarios of low impact development in Fairfax County for four types of development: single family residential, residential townhomes, commercial and "big box" retail. <http://lowimpactdevelopment.org/fairfax.htm>

Also in Northern Virginia, Fort Belvoir Residential Communities has received numerous awards for low impact development and energy efficiency. The community (the builder who renovated the neighborhood) has been recognized by the Commonwealth of Virginia (Environmental Stewardship), the Virginia Sustainable Building Network, and by national organizations. <http://aec.army.mil/usaec/newsroom/update/spr08/spr0817.html>

For more examples of award winning case studies, see XII. Case Studies.



# IX. Window into Land Use and Natural Hazards

## 9.8 Materials List

### **9 – 1 *Subdivision Design***

- Overheads illustrating various community design methods

### **9 – 2 *Stakeholder Analysis***

- None

### **9 – 3 *Chesapeake Bay***

- Magazines
- Glue
- Scissors
- Poster board

### **9 – 4 *Tire Recycling***

- Computers
- Library resources

### **9 – 5 *Natural Disasters***

- None



# IX. Window into Land Use and Natural Hazards

## 9.9 Activities

### **9 – 1 Subdivision Design**

Students will plan their own subdivision however they would like. They should be able to explain their reasoning for the overall layout of the community

### **9 – 2 Stakeholder Analysis**

Students are given a hypothetical situation of placing growth boundaries around a community. They are asked to act out as “stakeholders” or “key players” and discuss why or why not growth boundaries should be placed.

### **9 – 3 Chesapeake Bay**

Group work will be put to use to create a collage of the Chesapeake Bay and the how these components could be made better. Students may learn more about the water with the packets found at Project Oceanography. They can test different waters with nitrate kits and what factors may be affecting the water.

### **9 – 4 Tire Recycling**

Students will learn about tire recycling and how tires are recycled. Students are asked to look for recycling centers in their community and how their parents recycle tires.

### **9 – 5 Natural Disasters**

A discussion of tax money usage focuses on whether our tax money should pay for the effects of natural disasters and if people should be allowed to live where natural disasters occur.

## **9 – 1   *Subdivision Design***

### ***Purpose***

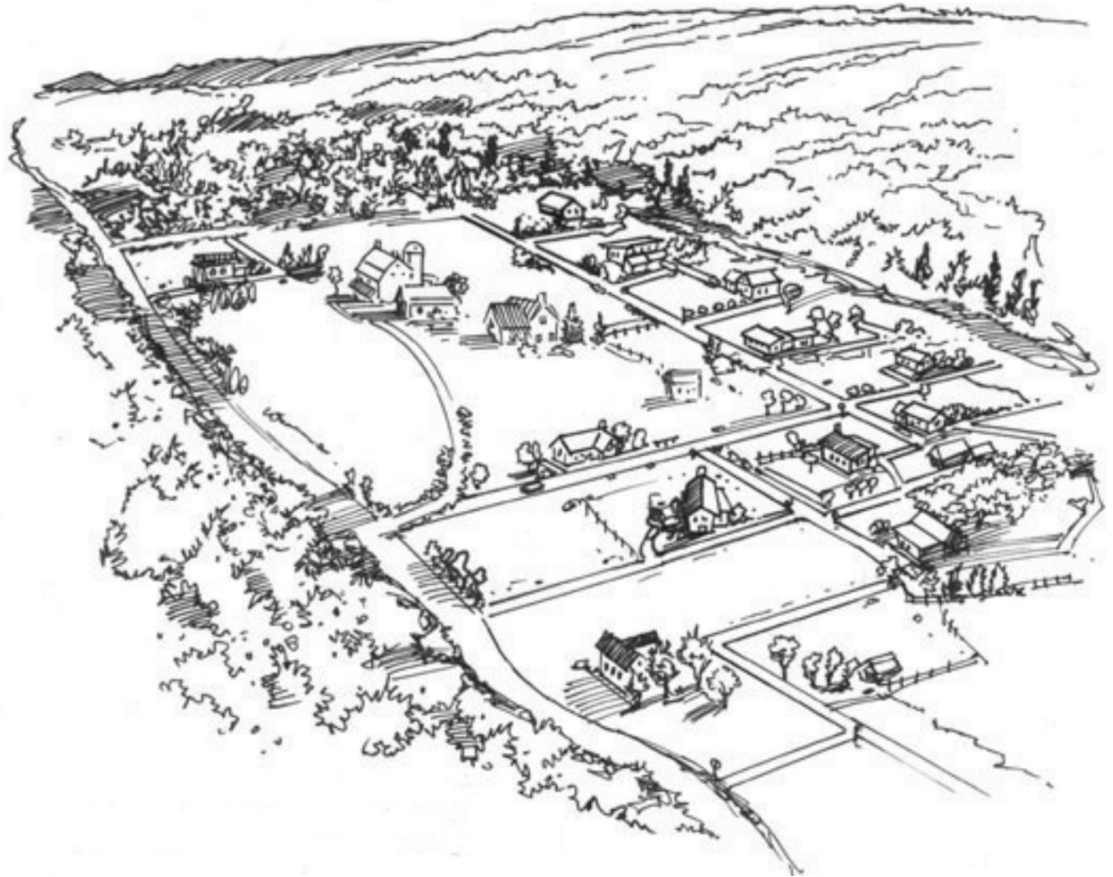
Students will discuss land use method examples provided on overheads following the activities section.

### ***Procedure***

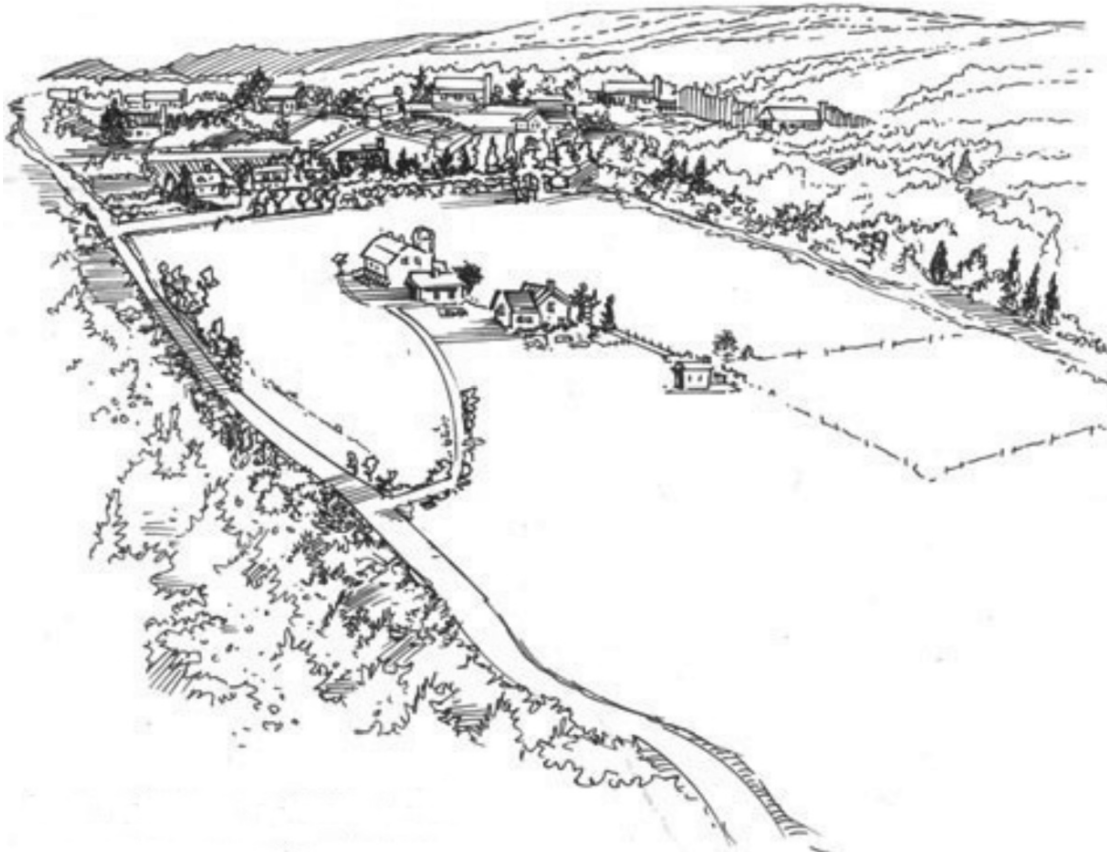
- Have the students work in groups to identify and elaborate on the positive and negative aspects of each of the first two designs.
- Then as a group the students will design their own subdivision. They should be able to explain their reasoning behind the placement of each of the buildings and the environmental considerations that they are taking into account while deciding on the placement of the buildings.

## 9 - 1 Subdivision Design

*Overhead A –  
Dispersed  
Land Use*



*Overhead B –  
Intensive  
Land Use*





## 9 – 2 Stakeholder Analysis

### Purpose

Facing a hypothetical situation, students will be asked to determine the most beneficial use of land and the steps needed to make this decision.

### Procedure

- Give the students a hypothetical situation where the community must decide upon whether or not to place growth boundaries around their community and where these potential boundaries would be placed.
- Ask the students to identify the “stakeholders” or “key players” who must be included in the community-wide discussion.

*Answer:* Students should name at least the following stakeholders: developer, landowner inside growth boundary, landowner outside growth boundary, farmer, town mayor, environmentalist, business owner, citizen/tax payer, elderly person, and young professional.

- Ask the students to role play, assigning individual students or a group of students the roles of stakeholders mentioned in step 2.
- **Developer:** growth boundaries will hurt his business and he will make less money. He does not want urban growth boundaries at all.
- **Landowner inside growth boundary:** this person is happy his property is inside the growth boundary because his property values are going to increase because the demand for property will increase inside the growth boundary. He is in favor of the boundary, as long as his property remains inside.
- **Landowner outside growth boundary:** this owner is upset because he will no longer be able to develop his property if the boundary is made without including his property. He will take the local government to court if they put up a boundary not including his land because he feels it is a violation of his property rights.
- **Farmer:** this farmer is excited. He is happy about the boundary because there will be less pressure on him from developers to buy his property to create subdivisions. Though it removes his option to sell, he supports the boundary.
- **Town mayor:** she will agree with the majority of the citizens. If she feels more of her constituents are development oriented, she will not be in favor of the growth boundary. On the other hand, if she feels the citizens are conservation/preservation/anti-sprawl oriented, she will favor the growth boundary.
- **Environmentalist:** in high favor of the growth boundary.
- **Business owner with business located inside the boundary:** in favor of the growth boundary because sprawling development and more business outside of the central downtown will draw business away from him.

- **Business owner of multiple chain business:** she has multiple branches and she wants to expand and build additional establishments, so she will not support the growth boundary because an increase in development is potential revenue for her business.
- **Citizen/taxpayers:** in favor of the growth boundary because they realize increased development means added government services to these far-reaching areas, possibly putting a net tax drain on the public budget.
- **Elderly citizen:** the elderly citizen remembers the days when there was almost no development. This citizen has seen the landscape change so dramatically over the last fifty years. She would support the growth boundary because she would like her grandchildren to have some idea of what this country looked like when she was young.
- **Young professional:** this educated, active person is looking for a high quality of life. He wants recreational opportunities and a beautiful environment to raise a family in the future. He is in favor of the progressive urban growth boundary.



## 9 – 3 *Chesapeake Bay*

### **Purpose**

Listed below are several simple activities to help students appreciate the Chesapeake Bay and the need to protect it.

### **Procedure**

- Have students get into groups and after further investigation of the problems the Bay faces, make a group presentation on a way they can help to “Save the Bay” by monitoring their everyday practices.
- Have students explore the plant and/or animal life that is specific to the Bay and how it is affected by pollution.
- Make a collage of the Bay as it currently exists and explain the components of the collage and how the situation could be made better.
- Project Oceanography provides teacher packets that include lesson objectives, background information, and student activities. Have students form groups and visit websites to research other topics related to water quality, then present their findings to the class.  
<http://www.marine.usf.edu/pjocean/packets/>
- Nitrate test kits can be found at your local aquarium store. Have students gather water samples from nearby streams, lakes, or oceans and test the samples for nitrate levels. Which samples have the highest nitrate levels? What factors could be contributing to the increased levels

*Answer:* fertilizers for crops, manure from livestock

- Other activities and resources for students and teachers are available from the Chesapeake Bay Foundation. You can view their web page by clicking on <http://www.cbf.org>
- Professional development opportunities for teachers are also available through the Foundation. To view this information click on the following web address:  
[http://www.cbf.org/site/PageServer?pagename=edu\\_tpd\\_landing](http://www.cbf.org/site/PageServer?pagename=edu_tpd_landing)



## **9 – 4 Tire Recycling**

### **Purpose**

The following activities complement students' understanding of tire disposal and re-use. Visit <http://www.deq.virginia.gov/wastetires/> for current information about tire clean up in Virginia.

### **Procedure**

- Identify if there are any tire dumps within your county and the volume of the tire dumps.
- Identify if there are any tire recycling centers in your county.
- Conduct research to determine whether your county is willing to use recycled tires in playgrounds, and work to implement it.
- Have students write a report about their parents' habits with tires. Have students examine if their parents are helping to prevent stockpiling of tires by the four suggestions maintained by the Rubber Manufacturers Association.
- Have students research other ways to recycle tires to benefit the environment.

## 9 – 5 Natural Disasters

### Purpose

Discuss government involvement in natural disaster areas.

### Procedure

- Discuss with your students the topic of: Should the governments continue to use taxpayers' money to help rebuild buildings in areas where they are most likely to be destroyed again in the future?
- Should people be allowed to build their homes and locate their businesses in areas prone to flooding and other natural disasters?

### ***This activity is a Cost-Benefit Analysis of Flood Insurance.***

In the United States, floods cause an annual average loss of \$3.5 billion (National Weather Service). The biggest loss was in 1993, when “The Great Flood of 1993” cost \$16.4 billion. Flood insurance is a major issue for people living in areas prone to flooding. The National Flood Insurance Program (NFIP) was created by Congress in 1968 to help offset the taxpayer’s burden for disaster relief due to floods. It has paid more than \$11.6 billion in claims since 1978 (Longley, 1). The Federal Emergency Management Agency (FEMA) manages the NFIP and has to determine the risk of flooding in a particular area. If a community enforces floodplain management ordinances designed to reduce future flood loss, the NFIP makes federal flood insurance available to business and homeowners in the community. More than 19,000 communities participate in the program. Efforts from such partnerships between NFIP and communities reduce annual flood loss by almost \$1 billion. Buildings that are in compliance with NFIP standards experience about eighty percent less damage when flooded. The premiums for NFIP pay for all claims, relieving the taxpayer burden.

Flood insurance is legally required to get financing for buying and building structures that are located in Special Flood Hazard Areas (SFHA). Buildings in an SFHA have a 26 percent chance of flooding in a thirty-year period (a typical mortgage length) (Longley, 2). This is a much higher risk than the building catching on fire which carries a 4 percent chance. Buyers of property in an SFHA have no choice. They must buy flood insurance. What about buyers that are not located in an SFHA? Should they protect their investment with flood insurance? Keep in mind that one in four flood claims occur in low to moderate risk areas and to be eligible for federal disaster relief, the flood must be declared a disaster by the President.

Why would a homeowner choose not to buy flood insurance? The sometimes high premiums and deductibles coupled with policies that provide limited coverage cause many homeowners to decide against flood insurance. Many people believe that it will never happen to them, and that they do not need flood insurance. If a claim is never filed, many homeowners see their premiums as a loss. It is really a matter of chance. Can you afford to take that chance? Can you afford to rebuild your home on your own if you experience a flood? These are the kind of questions that home and business owners must consider. The average premium for NFIP is \$370 per year, but the average payment for a disaster home loan in the amount of \$50,000 is \$311 per month (National Flood Insurance Guide, 3). Let’s look a little closer at the numbers. The average age of first-time homebuyers is 32 (Foglio, 32). Since the average life expectancy for a person in the United States is 77, this means they would pay insurance premiums for 45 years. The premiums total \$16,650. One must also consider the deductible.

Private insurance companies could charge deductibles between \$5,000 and \$25,000, but NFIP policies carry a much lower deductible of \$500 to \$1,000. So, let's add an additional \$750 for the deductible if there is a claim.

<i>Items</i>	<i>No Claims</i>	<i>Claim Filed</i>
Premium cost over 45 years	\$16,650	\$16,650
Deductible	\$0	\$750
<b>Total</b>	<b>\$16,650</b>	<b>\$17,400</b>

If there is a flood in our lifetime, the total of \$17,400 would cover our losses. What if there is no flood? What else could we have done with our money? What if we had not spent our money on insurance, but invested it instead? According to Investment Company Institutes investment calculator, if we deposited our monthly premiums each month, over the course of 45 years, we would end up with about \$27,000. It comes down to weighing the risks versus our ability to pay if there is a flood. A person who could afford to rebuild their own home at the time of a flood, and does not live in a particularly high risk area might do better to invest their money instead of paying for insurance, but for people that would end up homeless, it is probably worth the premium for coverage.

Floods not only result in property damage, but they cost everyone money in other ways. Additional costs, such as a lot of foreclosures on home loans resulting in higher interest rates, can cost the community a lot of money. Also, there are other indirect costs like missed work resulting in lower productivity for businesses and lost wages for employees. There are also healthcare costs due to flood related injuries. Floods cost a lot of money and flood insurance should be given careful consideration.

### **Reflection**

Find the risk of flooding in your area. Based on what you have learned, do you think homeowners should buy flood insurance? Why or why not?



# IX. Window into Land Use and Natural Hazards

## 9.10 References

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